



Revision Guide for AMD Family 15h Models 10h-1Fh Processors

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Advanced Micro Devices 

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Revision History

Date	Revision	Description
June 2012	3.02	Added AMD R-Series APU embedded brand to Overview, Table 2, Table 3, and Table 9; Added AMD A-Series APU to Overview and Table 4; Added FP2 and FM2 packages to Table 2, Table 4, Table 5, and Table 8.
May 2012	3.00	Initial public release.

Overview

The purpose of the *Revision Guide for AMD Family 15h Models 10h-1Fh Processors* is to communicate updated product information to designers of computer systems and software developers. This revision guide includes information on the following products:

- AMD A-Series Accelerated Processing Unit (APU) with AMD Radeon™ HD Graphics
- AMD A-Series Mobile Accelerated Processing Unit (APU) with AMD Radeon HD Graphics
- AMD R-Series Accelerated Processing Unit (APU) with AMD Radeon HD Graphics

This guide consists of these major sections:

- [Processor Identification](#) shows how to determine the processor revision and workaround requirements, and to construct, program, and display the processor name string.
- [Product Errata](#) provides a detailed description of product errata, including potential effects on system operation and suggested workarounds. An erratum is defined as a deviation from the product's specification, and as such may cause the behavior of the processor to deviate from the published specifications.
- [Documentation Support](#) provides a listing of available technical support resources.

Revision Guide Policy

Occasionally, AMD identifies product errata that cause the processor to deviate from published specifications. Descriptions of identified product errata are designed to assist system and software designers in using the processors described in this revision guide. This revision guide may be updated periodically.

Conventions

Numbering

- **Binary numbers.** Binary numbers are indicated by appending a "b" at the end, e.g., 0110b.
- **Decimal numbers.** Unless specified otherwise, all numbers are decimal. This rule does not apply to the register mnemonics.
- **Hexadecimal numbers.** Hexadecimal numbers are indicated by appending an "h" to the end, e.g., 45F8h.
- **Underscores in numbers.** Underscores are used to break up numbers to make them more readable. They do not imply any operation. e.g., 0110_1100b.
- **Undefined digit.** An undefined digit, in any radix, is notated as a lower case "x".

Register References and Mnemonics

In order to define errata workarounds it is sometimes necessary to reference processor registers. References to registers in this document use a mnemonic notation consistent with that defined in the *BIOS and Kernel Developer's Guide (BKDG) for AMD Family 15h Models 10h-1Fh Processors*, order# 42300. Each mnemonic is a concatenation of the register-space indicator and the offset of the register. The mnemonics for the various register spaces are as follows:

- **IOXXX:** x86-defined input and output address space registers; XXX specifies the byte address of the I/O register in hex (this may be 2 or 3 digits). This space includes the I/O-Space Configuration Address Register (IOCF8) and the I/O-Space Configuration Data Port (IOCFC) to access configuration registers.
- **DZFYxXXX:** PCI-defined configuration space at bus 0; Z specifies the PCI device address in hex; XXX specifies the byte address of the configuration register (this may be 2 or 3 digits) in hex; Y specifies the function number. For example, D18F3x40 specifies the register at bus 0, device 18h, function 3, address 40h. Some registers in D18F2xXXX have a `_dct[1:0]` mnemonic suffix, which indicates there is one instance per DRAM controller (DCT). The DCT instance is selected by DCT Configuration Select[DctCfgSel] (D18F1x10C[0]). Some registers in D18F2xXXX have an `_mp[1:0]` mnemonic suffix, which indicates there is one instance per memory P-state. The memory P-state instance is selected by DCT Configuration Select[MemPsSel] (D18F1x10C[3]).
- **DZFYxXXX_xZZZZZ:** Port access through the PCI-defined configuration space at bus 0; Z specifies the PCI device address in hex; XXX specifies the byte address of the data port configuration register (this may be 2 or 3 digits) in hex; Y specifies the function number; ZZZZZ specifies the port address (this may be 2 to 7 digits) in hex. For example, D18F2x9C_x1C specifies the port 1Ch register accessed using the data port register at bus 0, device 18h, function 2, address 9Ch. Refer to the *BIOS and Kernel Developer's Guide (BKDG) for AMD Family 15h Models 10h-1Fh Processors*, order# 42300 for access properties. Some registers in D18F2xXXX_xZZZZZ have a `_dct[1:0]` mnemonic suffix, which indicates there is one instance per DRAM controller (DCT). The DCT instance is selected by DCT Configuration Select[DctCfgSel] (D18F1x10C[0]). Some registers in D18F2xXXX_xZZZZZ have an `_mp[1:0]` mnemonic suffix, which indicates there is one instance per memory P-state. The memory P-state instance is selected by DCT Configuration Select[MemPsSel] (D18F1x10C[3]).
- **APICXXX:** APIC memory-mapped registers; XXX is the byte address offset from the base address in hex (this may be 2 or 3 digits). The base address for this space is specified by the APIC Base Address Register (APIC_BAR) at MSR0000_001B.

- **CPUID FnXXXX_XXXX_RRR_xYYY**: processor capability information returned by the CPUID instruction where the CPUID function is XXXX_XXXX (in hex) and the ECX input is YYY (if specified). When a register is specified by RRR, the reference is to the data returned in that register. For example, CPUID Fn8000_0001_EAX refers to the data in the EAX register after executing CPUID instruction function 8000_0001h.
- **MSRXXXX_XXXX**: model specific registers; XXXX_XXXX is the MSR number in hex. This space is accessed through x86-defined RDMSR and WRMSR instructions.
- **PMCxXXX[Y]**: performance monitor events; XXX is the hexadecimal event counter number programmed into MSRC001_020[A,8,6,4,2,0][EventSelect] (PERF_CTL[5:0] bits 7:0). Y, when specified, signifies the unit mask programmed into MSRC001_020[A,8,6,4,2,0][UnitMask] (PERF_CTL[5:0] bits 15:8).
- **NBPMCxXXX[Y]**: northbridge performance monitor events; XXX is the hexadecimal event counter number programmed into MSRC001_024[6,4,2,0][EventSelect] (NB_PERF_CTL[3:0] bits 7:0). Y, when specified, signifies the unit mask programmed into MSRC001_024[6,4,2,0][UnitMask] (NB_PERF_CTL[3:0] bits 15:8).

Many register references use the notation "[]" to identify a range of registers. For example, D18F2x[1,0][4C:40] is a shorthand notation for D18F2x40, D18F2x44, D18F2x48, D18F2x4C, D18F2x140, D18F2x144, D18F2x148, and D18F2x14C.

Arithmetic and Logical Operators

In this document, formulas follow some Verilog conventions as shown in [Table 1](#).

Table 1. Arithmetic and Logic Operators

Operator	Definition
{ }	Curly brackets are used to indicate a group of bits that are concatenated together. Each set of bits is separated by a comma. E.g., {Addr[3:2], Xlate[3:0]} represents a 6-bit value; the two MSBs are Addr[3:2] and the four LSBs are Xlate[3:0].
	Bitwise OR operator. E.g. (01b 10b == 11b).
	Logical OR operator. E.g. (01b 10b == 1b); logical treats multibit operand as 1 if >=1 and produces a 1-bit result.
&	Bitwise AND operator. E.g. (01b & 10b == 00b).
&&	Logical AND operator. E.g. (01b && 10b == 1b); logical treats multibit operand as 1 if >=1 and produces a 1-bit result.
^	Bitwise exclusive-OR operator; sometimes used as "raised to the power of" as well, as indicated by the context in which it is used. E.g. (01b ^ 10b == 11b). E.g. (2^2 == 4).
~	Bitwise NOT operator (also known as one's complement). E.g. (~10b == 01b).
!	Logical NOT operator. E.g. (!10b == 0b); logical treats multibit operand as 1 if >=1 and produces a 1-bit result.
==	Logical "is equal to" operator.
!=	Logical "is not equal to" operator.
<=	Less than or equal operator.
>=	Greater than or equal operator.
*	Arithmetic multiplication operator.
/	Arithmetic division operator.
<<	Shift left first operand by the number of bits specified by the 2nd operand. E.g. (01b << 01b == 10b).
>>	Shift right first operand by the number of bits specified by the 2nd operand. E.g. (10b >> 01b == 01b).

Processor Identification

This section shows how to determine the processor revision, program and display the processor name string, and construct the processor name string.

Revision Determination

A processor revision is identified using a unique value that is returned in the EAX register after executing the CPUID instruction function 0000_0001h (CPUID Fn0000_0001_EAX). [Figure 1](#) shows the format of the value from CPUID Fn0000_0001_EAX. In some cases, two or more processor revisions may exist within a stepping of a processor family and are identified by a unique value in D18F4x164 Fixed Errata Register (see [D18F4x164 Fixed Errata Register](#)).

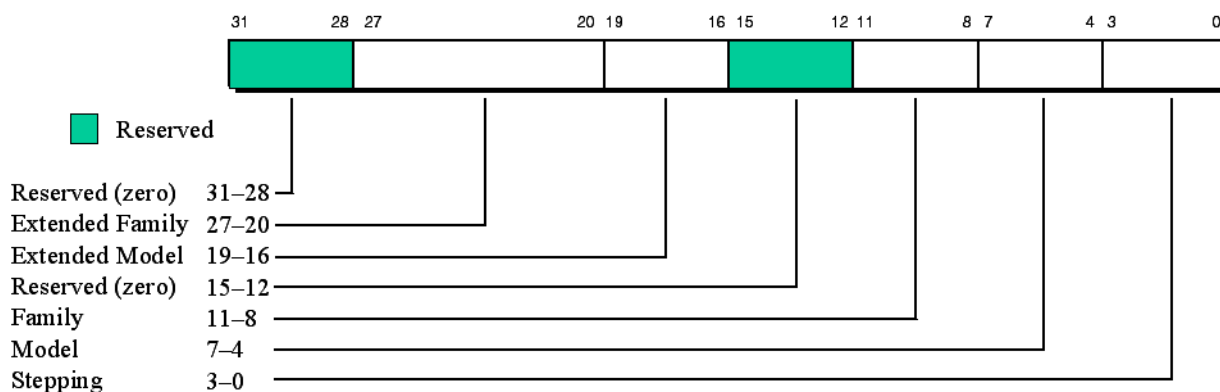


Figure 1. Format of CPUID Fn0000_0001_EAX

The following tables show the identification numbers from CPUID Fn0000_0001_EAX and D18F4x164 (if necessary) for each revision of the processor to each processor segment. "X" signifies that the revision has been used in the processor segment. "N/A" signifies that the revision has not been used in the processor segment.

Table 2. CPUID Values for AMD Family 15h Models 10h-1Fh FP2 Processor Revisions

CPUID Fn0000_0001_EAX (Mnemonic)	AMD R-Series APU	AMD A-Series Mobile APU
00610F01h (TN-A1)	X	X

Table 3. CPUID Values for AMD Family 15h Models 10h-1Fh FS1r2 Processor Revisions

CPUID Fn0000_0001_EAX (Mnemonic)	AMD A-Series Mobile APU	AMD R-Series APU
00610F01h (TN-A1)	X	X

Table 4. CPUID Values for AMD Family 15h Models 10h-1Fh FM2 Processor Revisions

CPUID Fn0000_0001_EAX (Mnemonic)	AMD A-Series APU
00610F01h (TN-A1)	X

Graphic Device IDs

Processors with an integrated AMD Radeon HD Graphics Processing Engine use a graphics device ID at D1F0x00[31:16] to further identify the processor. [Table 5](#) lists the graphic device ID values in use for AMD Family 15h Models 10h-1Fh Accelerated Processing Units.

Table 5. AMD Family 15h Graphic Device IDs

D1F0x00[31:16]	FP2	FM2	FS1r2	Notes
9900h			X	Mobile (4 Quad Pipes, 6 SIMD& Texture Units, 2 Render Backends)
9901h		X		Desktop (4 Quad Pipes, 6 SIMD& Texture Units, 2 Render Backends)
9903h			X	Mobile (4 Quad Pipes, 4 SIMD&Texture Units, 2 Render Backends)
9904h		X		Desktop (4 Quad Pipes, 4 SIMD&Texture Units, 2 Render Backends)
9906h		X		Workstation (4 Quad Pipes, 6 SIMD&Texture Units, 2 Render Backends)
9907h	X			Mobile (4 Quad Pipes, 6 SIMD&Texture Units, 2 Render Backends)
990Ah	X			Mobile (4 Quad Pipes, 4 SIMD&Texture Units, 2 Render Backends)
9990h			X	Mobile (4 Quad Pipes, 3 SIMD&Texture Units, 1 Render Backend)
9991h		X		Desktop (4 Quad Pipes, 3 SIMD&Texture Units, 1 Render Backend)
9993h		X		Desktop (4 Quad Pipes, 2 SIMD&Texture Units, 1 Render Backend)

Programming and Displaying the Processor Name String

This section, intended for BIOS programmers, describes how to program and display the 48-character processor name string that is returned by CPUID Fn8000_000[4:2]. The hardware or cold reset value of the processor name string is 48 ASCII NUL characters, so the BIOS must program the processor name string before any general purpose application or operating system software uses the extended functions that read the name string. It is common practice for the BIOS to display the processor name string and model number whenever it displays processor information during boot up.

Note: Motherboards that do not program the proper processor name string and model number will not pass AMD validation and will not be posted on the AMD Recommended Motherboard Web site.

The name string must be ASCII NUL terminated and the 48-character maximum includes that NUL character.

The processor name string is programmed by MSR writes to the six MSR addresses covered by the range MSRC001_00[35:30]h. Refer to the *BIOS and Kernel Developer's Guide (BKDG) for AMD Family 15h Models 10h-1Fh Processors*, order# 42300, for the format of how the 48-character processor name string maps to the 48 bytes contained in the six 64-bit registers of MSRC001_00[35:30].

The processor name string is read by CPUID reads to a range of CPUID functions covered by CPUID Fn8000_000[4:2]. Refer to CPUID Fn8000_000[4:2] in the *BIOS and Kernel Developer's Guide (BKDG) for AMD Family 15h Models 10h-1Fh Processors*, order# 42300, for the 48-character processor name string mapping to the 48 bytes contained in the twelve 32-bit registers of CPUID Fn8000_000[4:2].

Constructing the Processor Name String

This section describes how to construct the processor name string. BIOS uses the following fields to create the name string:

The name string is formed as follows:

1. If D18F5x198_x0 is 00000000h, then use a name string of "AMD Unprogrammed Engineering Sample" and skip the remaining steps.
2. Read {D18F5x198_x1, D18F5x198_x0} and write this value to MSRC001_0030.
3. Read {D18F5x198_x3, D18F5x198_x2} and write this value to MSRC001_0031.
4. Read {D18F5x198_x5, D18F5x198_x4} and write this value to MSRC001_0032.
5. Read {D18F5x198_x7, D18F5x198_x6} and write this value to MSRC001_0033.
6. Read {D18F5x198_x9, D18F5x198_x8} and write this value to MSRC001_0034.
7. Read {D18F5x198_xB, D18F5x198_xA} and write this value to MSRC001_0035.

D18F4x164 Fixed Errata Register

Communicating the status of an erratum within a stepping of a processor family is necessary in certain circumstances. D18F4x164 is used to communicate the status of such an erratum fix so that BIOS or system software can determine the necessity of applying the workaround. Under these circumstances, the erratum workaround references the specified bit to enable software to test for the presence of the erratum. The erratum may be specific to some steppings of the processor, and the specified bit may or may not be set on other unaffected revisions within the same family. Therefore, software should use the CPUID Fn00000_0001_EAX extended model, model, and stepping as the first criteria to identify the applicability of an erratum. Once defined, the definition of the status bit will persist within the family of processors.

Bits	Description
31:0	0000_0000h. Reserved.

Operating System Visible Workarounds

This section describes how to identify operating system visible workarounds.

MSRC001_0140 OS Visible Work-around MSR0 (OSVW_ID_Length)

This register, as defined in *AMD64 Architecture Programmer's Manual Volume 2: System Programming*, order# 24593, is used to specify the number of valid status bits within the OS Visible Work-around status registers.

The reset default value of this register is 0000_0000_0000_0000h.

BIOS shall program the OSVW_ID_Length to 0005h prior to hand-off to the OS.

Bits	Description
63:16	Reserved.
15:0	OSVW_ID_Length : OS visible work-around ID length. Read-write.

MSRC001_0141 OS Visible Work-around MSR1 (OSVW_Status)

This register, as defined in *AMD64 Architecture Programmer's Manual Volume 2: System Programming*, order# 24593, provides the status of the known OS visible errata. Known errata are assigned an OSVW_ID corresponding to the bit position within the valid status field.

Operating system software should use MSRC001_0140 to determine the valid length of the bit status field. For all valid status bits: 1=Hardware contains the erratum, and an OS software work-around is required or may be applied instead of a BIOS workaround. 0=Hardware has corrected the erratum, so an OS software work-around is not necessary.

The reset default value of this register is 0000_0000_0000_0000h.

Bits	Description
63:5	OsvwStatusBits : Reserved. OS visible work-around status bits. Read-write.
4	OsvwId4: 1 = Hardware contains erratum #724 , an OS workaround may be applied if available; 0 = Hardware has corrected erratum #724 .
3	OsvwId3 : Reserved, must be zero.
2	OsvwId2 : Reserved, must be zero.
1	OsvwId1 : Reserved, must be zero.
0	OsvwId0 : Reserved, must be zero.

BIOS shall program the state of the valid status bits as shown in [Table 6](#) prior to hand-off to the OS.

Table 6. Cross Reference of Product Revision to OSVW ID

CPUID Fn0000_0001_EAX (Mnemonic)	MSRC001_0141 Bits
00610F01h (TN-A1)	0000_0000_0000_0010h

Product Errata

This section documents product errata for the processors. A unique tracking number for each erratum has been assigned within this document for user convenience in tracking the errata within specific revision levels. This table cross-references the revisions of the part to each erratum. "No fix planned" indicates that no fix is planned for current or future revisions of the processor.

Note: There may be missing errata numbers. Errata that do not affect this product family do not appear. In addition, errata that have been resolved from early revisions of the processor have been deleted, and errata that have been reconsidered may have been deleted or renumbered.

Table 7. Cross-Reference of Processor Revision to Errata

No.	Errata Description	CPUID Fn0000_0001_EAX
		00610F01h (TN-A1)
361	Breakpoint Due to an Instruction That Has an Interrupt Shadow May Be Lost	No fix planned
470	Warm Reset May Cause System Hang	No fix planned
608	P-state Limit Changes May Not Generate Interrupts	No fix planned
625	SB-RMI Writes May Not Be Observed by Processor	No fix planned
638	Processor May Violate Trp During Dynamic Mode Switch	No fix planned
657	MC1_STATUS Enable Bit Not Set When Logging Corrected Errors	No fix planned
661	P-State Limit and Stop Clock Assertion May Cause System Hang	No fix planned
663	Local Interrupts LINT0/LINT1 May Occur While APIC is Software Disabled	No fix planned
667	Processor May Generate Incorrect P-state Limit Interrupts	No fix planned
671	Debug Breakpoint on Misaligned Store May Cause System Hang	No fix planned
685	Some Processor Cores May Have Inaccurate Instruction Cache Fetch Performance Counter	No fix planned
686	Processor Does Not Implement MSRC001_0055	No fix planned
687	Memory Arbitration May Stall	No fix planned
693	Performance Counter May Incorrectly Count MXCSR Loads	No fix planned
694	IBS Sampling of Instruction Fetches May Be Uneven	No fix planned
695	Processor May Interpret FCW Incorrectly after FNSAVE/FSAVE Limit Fault	No fix planned
697	P-State Limit Removal During PC6 Entry May Cause System Hang	No fix planned
698	Processor May Not Recognize P-state Limit Changes During Northbridge P-state Transition	No fix planned
699	Processor May Generate Illegal Access in VMLOAD or VMSAVE Instruction	No fix planned

Table 7. Cross-Reference of Processor Revision to Errata (continued)

No.	Errata Description	CPUID Fn0000_0001_EAX
		00610F01h (TN-A1)
703	SB-RMI Access While Northbridge is Power Gated May Cause Interface Hang	No fix planned
704	Processor May Report Incorrect Instruction Pointer	No fix planned
707	Performance Counter for Locked Operations May Count Cycles from Non-Locked Operations	No fix planned
709	Processor May Be Limited to Minimum P-state After a P-state Limit Change	No fix planned
712	Processor May Hang During Graphics Memory Controller Sequencing	No fix planned
713	Processor May Hang Due to Short Graphics Memory Controller Activity	No fix planned
715	Processor May Alter Machine Check Registers on a Warm Reset	No fix planned
716	Warm Reset After BIOS Changes P-state During Early Boot May Cause System Hang	No fix planned
718	Instruction-Based Sampling May Be Inaccurate	No fix planned
719	Instruction-Based Sampling Fetch Counter Always Starts at Maximum Value	No fix planned
720	Processor May Not Respect Interrupt Shadow	No fix planned
724	Unintercepted Halt Instruction May Cause Protocol Machine Check or Unpredictable System Behavior	No fix planned
725	Incorrect APIC Remote Read Behavior	No fix planned
726	Processor May Report Incorrect MCA Address for Loads that Cross Address Boundaries	No fix planned
728	IOMMU Event Not Flagged when DTE Reserved Bits Are Not Zero	No fix planned
729	IOMMU Event Log Not Generated for Invalid DTE GCR3 Table Root Pointer	No fix planned
730	IOMMU Event Log Not Generated for Not Present Host Intermediate Page Tables	No fix planned
731	Incorrect Translation with IOMMU v1 512 GB Page Table	No fix planned
732	IOMMU Event Log Ordering Violation	No fix planned
733	IOMMU PPR Log Ordering Violation	No fix planned

Cross-Reference of Errata to Package Type

This table cross-references the errata to each package type. "X" signifies that the erratum applies to the package type. An empty cell signifies that the erratum does not apply. An erratum may not apply to a package type due to a specific characteristic of the erratum, or it may be due to the affected silicon revision(s) not being used in this package.

Table 8. Cross-Reference of Errata to Package Type

Errata	Package		
	FM2	FP2	FS1r2
361	X	X	X
470	X	X	X
608	X	X	X
625	X	X	X
638	X	X	X
657	X	X	X
661	X	X	X
663	X	X	X
667	X	X	X
671	X	X	X
685	X	X	X
686	X	X	X
687	X	X	X
693	X	X	X
694	X	X	X
695	X	X	X
697	X	X	X
698	X	X	X
699	X	X	X
703	X	X	X
704	X	X	X
707	X	X	X
709	X	X	X
712	X	X	X
713	X	X	X
715	X	X	X
716	X	X	X
718	X	X	X

**Table 8. Cross-Reference
of Errata to Package Type
(continued)**

Errata	Package		
	FM2	FP2	FS1r2
719	X	X	X
720	X	X	X
724	X	X	X
725	X	X	X
726	X	X	X
728	X	X	X
729	X	X	X
730	X	X	X
731	X	X	X
732	X	X	X
733	X	X	X

Cross-Reference of Errata to Processor Segments

This table cross-references the errata to each processor segment. "X" signifies that the erratum applies to the processor segment. An empty cell signifies that the erratum does not apply. An erratum may not apply to a processor segment due to a specific characteristic of the erratum, or it may be due to the affected silicon revision(s) not being used in this processor segment.

Table 9. Cross-Reference of Errata to Processor Segments

Errata	Processor Segment		
	AMD A-Series APU	AMD A-Series Mobile APU	AMD R-Series APU
361	X	X	X
470	X	X	X
608	X	X	X
625	X	X	X
638	X	X	X
657	X	X	X
661	X	X	X
663	X	X	X
667	X	X	X
671	X	X	X
685	X	X	X
686	X	X	X
687	X	X	X
693	X	X	X
694	X	X	X
695	X	X	X
697	X	X	X
698	X	X	X
699	X	X	X
703	X	X	X
704	X	X	X
707	X	X	X

**Table 9. Cross-Reference
of Errata to Processor
Segments (continued)**

Errata	Processor Segment		
	AMD A-Series APU	AMD A-Series Mobile APU	AMD R-Series APU (embedded)
709	X	X	X
712	X	X	X
713	X	X	X
715	X	X	X
716	X	X	X
718	X	X	X
719	X	X	X
720	X	X	X
724	X	X	X
725	X	X	X
726	X	X	X
728	X	X	X
729	X	X	X
730	X	X	X
731	X	X	X
732	X	X	X
733	X	X	X

361 Breakpoint Due to an Instruction That Has an Interrupt Shadow May Be Lost

Description

A #DB exception occurring in guest mode may be discarded under the following conditions:

- A trap-type #DB exception is generated in guest mode during execution of an instruction with an interrupt shadow, and
- The instruction that generated the exception is immediately followed by an instruction resulting in #VMEXIT.

Potential Effect on System

None expected under normal conditions. Debug exceptions may not be received for programs running under a hypervisor.

Suggested Workaround

None.

Fix Planned

No fix planned

470 Warm Reset May Cause System Hang

Description

The processor may hang if a warm reset occurs while a register access to any of the PCI Express® controllers' internal registers is in progress. The processor may perform register accesses for internal management purposes that are transparent to software.

Potential Effect on System

System hang.

Suggested Workaround

System BIOS should set D0F0xE4_x013[3:0]_8063 bits 4, 5, 12, 13 and 14 to 1b. This must be done early in the BIOS boot sequence to minimize the possibility of a hang due to a warm reset during the boot sequence.

During a link reconfigure operation, system BIOS must perform the following steps:

1. Clear D0F0xE4_x013[3:0]_8063 bits 4, 5, 12, 13 and 14 to 0b.
2. Perform the link reconfigure operation.
3. Set D0F0xE4_x013[3:0]_8063 bits 4, 5, 12, 13 and 14 to 1b.

Fix Planned

No fix planned

608 P-state Limit Changes May Not Generate Interrupts

Description

P-state limit changes fail to generate interrupts when the target P-state limit is a higher or equal performance P-state (lower or equal numbered P-state) than the Application Power Management (APM) P-state limit.

Potential Effect on System

Operating systems monitoring processor P-state capabilities may not be notified of all P-state limit changes, resulting in either one of the following conditions:

- The processor runs continuously in a lower performance (higher numbered) P-state than is actually available.
- The operating system may request a higher performance (lower numbered) P-state than is actually available.

Suggested Workaround

BIOS should set MSRC001_1000[16] = 1b.

Fix Planned

No fix planned

625 SB-RMI Writes May Not Be Observed by Processor

Description

After a write using the APML SB-RMI interface to either the Inbound Message Registers (SBRMI_x3[F:8]) or Software Interrupt Register (SBRMI_x40), the processor may observe the previous contents (as if the write did not occur) when reading these same registers using the SBI Address/Data registers (D18F3x1E8 and D18F3x1EC). The conditions under which this erratum may occur requires that northbridge clock gating is enabled for any C-state action (C-state Control[NbClkGate2, NbClkGate1, NbClkGate0], D18F4x118[27, 11], D18F4x11C[11]). The functionality of the SB-RMI interface is not otherwise affected.

Potential Effect on System

Software running on the processor is not able to properly receive messages from system management software using the SB-RMI interface.

Suggested Workaround

None. In the event that system management software needs to communicate with software running on the processor, an alternative mechanism should be used.

Fix Planned

No fix planned

638 Processor May Violate Trp During Dynamic Mode Switch

Description

The processor may violate the precharge time (Trp) for a DIMM when sending a mode register set (MRS) command to dynamically adjust MR0[PPD] during a precharge power down.

This erratum may occur only when fast exit/slow exit (dynamic) mode is selected as follows:

- D18F2x94_dct[1:0][15] = 1b (DRAM Configuration High[PowerDownEn])
- D18F2x84_dct[1:0][23] = 1b (DRAM MRS[PchgPDModeSel])

Potential Effect on System

Unpredictable system operation.

Suggested Workaround

If D18F2x84_dct[1:0] bit 23 (PchgPDModeSel) = 1b and D18F2x94_dct[1:0] bit 15 (PowerDownEn) = 1b, then precharge time (D18F2x200_dct[1:0]_mp[1:0] bits 20:16, Trp) should be set one higher than the DIMM specified value.

Fix Planned

No fix planned

657 MC1_STATUS Enable Bit Not Set When Logging Corrected Errors

Description

The processor does not set MC1_STATUS[En] = 1b (MSR0000_0405[60]) when logging an enabled and corrected error in the IF machine check register bank (bank 1).

Software can identify the corrected errors that are affected by this erratum when it observes an MC1_STATUS register with all of the following:

- MC1_STATUS[Valid] (bit 63) = 1b
- MC1_STATUS[Uc] (bit 61) = 0b
- MC1_STATUS[En] (bit 60) = 0b
- MC1_STATUS[Pcc] (bit 57) = 0b
- The corresponding enable bit in MC1_CTL (MSR0000_0404) = 1b

Potential Effect on System

None expected.

Suggested Workaround

None required.

Fix Planned

No fix planned

661 P-State Limit and Stop Clock Assertion May Cause System Hang

Description

A P-state limit change that occurs within a small timing window of a Stop Clock assertion may result in DRAM not entering self-refresh mode for an S3 sleep state transition.

Potential Effect on System

System hang.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

663 Local Interrupts LINT0/LINT1 May Occur While APIC is Software Disabled

Description

The processor unmask local interrupts (LINT0 and LINT1) while the APIC is software disabled (Spurious-Interrupt Vector Register[APICSWEn], APICF0[8] = 0b). The LINT[1:0] LVT entry mask bits (APIC3[60:50] bit 16) are cleared and cannot be set.

Broadcast ExtInt and NMI interrupt requests can be converted to LINT0 and LINT1 local interrupts respectively by setting Link Transaction Control Register[LintEn] (D18F0x68[16]) = 1b. If this bit is set while the APIC is software disabled, an ExtInt or NMI interrupt causes an unexpected local interrupt.

Potential Effect on System

Software may receive a local interrupt that was not expected, possibly leading to a system crash.

Suggested Workaround

BIOS should set MSRC001_001F[23] = 1b before enabling the APIC (APIC_BAR[ApicEn] (MSR0000_001B[11]) = 1b) or before setting Link Transaction Control[LintEn] (D18F0x68[16]) = 1b.

Fix Planned

No fix planned

667 Processor May Generate Incorrect P-state Limit Interrupts

Description

P-state limit changes due to SB-RMI (SBI P-state Limit[PstateLimit], MSRC001_0072[10:8]), software (Software P-state Limit Register[SwPstateLimit], D18F3x68[30:28]), or hardware thermal control (entering HTC-active state, i.e. PROCHOT# assertion) may generate duplicate interrupts when Hardware Thermal Control Register bits [PslApicLoEn, PslApicHiEn] are not both zero (D18F3x64[7:6] != 00b).

The processor actually uses APM TDP Control[ApmTdpLimitIntEn] = 1b to enable the generation of interrupts for P-state limit changes due to SB-RMI, software, or HTC.

Potential Effect on System

Operating systems monitoring processor P-state capabilities may receive duplicate notification of P-state limit changes due to SB-RMI, software, or HTC.

Suggested Workaround

BIOS should leave Hardware Thermal Control[PslApicLoEn, PslApicHiEn] at their default reset value (D18F3x64[7:6] = 00b) and should instead set APM TDP Control[ApmTdpLimitIntEn] (D18F4x16C[4]) = 1b. In addition, BIOS should set D18F4x16C[1] = 1b and D18F5xAC[3] = 1b.

Fix Planned

No fix planned

671 Debug Breakpoint on Misaligned Store May Cause System Hang

Description

A misaligned store that crosses cache lines and requires an address translation due to a TLB miss may cause a system hang if the trailing cache line has an address breakpoint enabled using DR7.

Potential Effect on System

System hang.

Suggested Workaround

Contact your AMD representative for information on a BIOS update. This workaround has a performance impact when certain debug breakpoints are enabled. AMD recommends that BIOS disables this workaround by setting MSRC001_1000[17] = 1b.

Fix Planned

No fix planned

685 Some Processor Cores May Have Inaccurate Instruction Cache Fetch Performance Counter

Description

The processor may over-report PMCx080 (instruction cache fetches) when the performance monitor is enabled on an odd processor core number (APIC20[ApicId] is odd - i.e. bit 24 is 1b), as compared to when the performance counter is used on an even processor core number.

Potential Effect on System

Performance monitoring software may not have an accurate count of instruction cache fetch operations. The performance counter may overcount.

Suggested Workaround

None.

Fix Planned

No fix planned

686 Processor Does Not Implement MSRC001_0055

Description

The processor does not properly allow writes to MSRC001_0055 (Interrupt Pending Register). A write to MSRC001_0055 is ignored and a read to the register returns zero.

Potential Effect on System

BIOS is unable to program this register.

Suggested Workaround

Contact your AMD representative for a BIOS workaround.

Fix Planned

No fix planned

687 Memory Arbitration May Stall

Description

The processor arbitration between CPU, I/O transactions and graphics transactions to the DRAM controller may not recognize and properly prioritize a CPU or I/O transaction that has been marked high priority. This causes the internal transaction arbiter to stall. This stall may occur only if the processor reports D18F3x1FC[29] = 0b (Product Information Register 1[EnDcqChgPriToHigh]).

Potential Effect on System

The memory bus may stall for excessive periods, causing display buffer under-run (screen corruption).

Suggested Workaround

BIOS should set D18F2x408_dct[1:0] bit 0 (GMC to DCT Control 2[CpuElevPrioDis]) = !D18F3x1FC[29] (the inverse of D18F3x1FC bit 29) and should set D18F5x88[14] = D18F3x1FC[29] (without inverting).

Fix Planned

No fix planned

693 Performance Counter May Incorrectly Count MXCSR Loads

Description

The processor may incorrectly increment the following performance counter due to XRSTOR, FXRSTOR, LDMXCSR or VLDMXCSR instructions loading the MXCSR register:

- PMCx003 (Retired Floating Point Ops)

Potential Effect on System

Performance monitoring software will not have an accurate count of the number of retired floating point operations reported by the above performance counter.

Suggested Workaround

None.

Fix Planned

No fix planned

694 IBS Sampling of Instruction Fetches May Be Uneven

Description

Instructions selected for instruction-based sampling (IBS) of fetch performance (Fetch Control[IbsFetchEn], MSRC001_1030[48] = 1b) may be sampled unevenly when the instruction fetch stream is redirected (e.g., due to a branch taken).

Potential Effect on System

Performance monitoring software may not receive even, unbiased IBS sampling of the instruction fetch stream. However, IBS can still be used effectively for identifying performance issues associated with specific instructions. The sampling bias makes IBS less effective for measuring the statistical distribution of operations and events.

Suggested Workaround

None.

Fix Planned

No fix planned

695 Processor May Interpret FCW Incorrectly after FNSAVE/FSAVE Limit Fault

Description

The processor operates as if the floating-point control word (FCW) has been initialized after executing an FNSAVE or FSAVE instruction which generates a stack limit fault (SS). This occurs when the instruction attempts to store the state of the floating-point unit to a memory location that crosses a 16-bit (0xFFFF) or 32-bit (0xFFFF_FFFF) address boundary in real or protected mode respectively, and persists until software reinitializes the FCW. The FXSAVE instruction is not affected by this erratum.

Potential Effect on System

None expected during normal operation. A stack limit fault while executing an FNSAVE or FSAVE instruction is unusual and AMD has not observed the above conditions in any commercially available software. In the unlikely event that software creates the conditions described above one of the following may occur:

- The processor may write an indefinite value, as if masked, when signaling an invalid-operation exception (IE) after an FLD instruction executes with invalid operands while invalid operations are unmasked (FCW.IM, bit 0 = 0b).
- The processor may set the FERR signal incorrectly after an FLDCW instruction updates the floating-point control word mask bits (FCW[5:0]). A subsequent floating point operation may then result in an incorrect or missing x87 floating-point exception (#MF).

Suggested Workaround

None required.

Fix Planned

No fix planned

697 P-State Limit Removal During PC6 Entry May Cause System Hang

Description

The processor may hang if the following conditions occur:

- A P-state limit has been applied that is actively restricting the current P-state to a lower-performing P-state than is requested by software. This limit may be due to application power management (APM), hardware thermal control (HTC), or Software P-state Limit Register[SwPstateLimit] (D18F3x68[30:28]).
- The P-state limit is an equal or lower performance (higher numbered) P-state than the pop-down P-state (Pop Up and Down P-states Register[PopDownPstate], D18F3xA8[31:29]).
- The P-state limit is removed during the period of time that the processor enters package C6 (PC6) state, i.e., the processor has a new P-state limit that is a lower P-state number (higher performing) than the previously applied P-state limit.

Potential Effect on System

System hang. While the conditions for the erratum occur during the entry to PC6, the hang is observed during the exit from PC6.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

698 Processor May Not Recognize P-state Limit Changes During Northbridge P-state Transition

Description

During the period of time that a northbridge P-state transition is in process, a concurrent core P-state limit change may not transition the core P-state to reflect this new limit. The core P-state limit change may be due to application power management (APM), hardware thermal control (HTC), or Software P-state Limit Register[SwPstateLimit] (D18F3x68[30:28]).

Potential Effect on System

If the core P-state limit changed to a higher P-state limit (i.e., the core P-state is now limited to lower performing P-states), then the processor cores may continue to operate at a P-state that is higher performing than this limit. This may result in a violation of the appropriate thermal design power (TDP).

If the core P-state limit changed to a lower P-state limit (i.e., the core P-state is no longer limited to lower performing P-states), then the processor cores may continue to operate at the lower performing P-states.

In addition, the processor does not generate an APIC330 interrupt for this P-state limit change.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

699 Processor May Generate Illegal Access in VMLOAD or VMSAVE Instruction

Description

The processor may generate a speculative access during execution of a VMLOAD or VMSAVE instruction. The memory type used for this access is defaulted to WB DRAM memory type, however the address used may not be a valid DRAM address or it may be an address that is not specified as cacheable in the memory type (i.e., the actual memory type is UC or WC).

Potential Effect on System

When the address is not a valid DRAM address, the processor may recognize a northbridge machine check exception for a link protocol error. This machine check exception causes a sync flood and system reset under AMD recommended BIOS settings. The machine check has the following signature:

- The MC4_STAT register (MSR0000_0411) is equal to BA000020_000B0C0F. Bit 62 (error overflow) or bit 59 (miscellaneous valid) of MC4_STAT may or may not be set.
- Bits 5:1 of the MC4_ADDR register (MSR0000_0412) is equal to 01001b, indicating that a coherent-only packet was issued to a non-coherent link.

When the address is actually a non-cacheable memory type, the processor may incorrectly cache the data, resulting in unpredictable system behavior.

AMD has only observed a northbridge link protocol error machine check. The incorrect caching of an uncacheable memory region has not been observed by AMD.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

703 SB-RMI Access While Northbridge is Power Gated May Cause Interface Hang

Description

The processor SB-RMI state machine may hang if a SB-RMI access is performed while the northbridge is power gated. The northbridge is power gated when all cores are in the core C6 (CC6) state and the applied C-state Control Register northbridge power gating bit (NbPwrGate[2:0]) is set to 1b (i.e., D18F4x11C[11], D18F4x118[26], or D18F4x118[11] is set to 1b).

Potential Effect on System

SB-RMI accesses may hang, resulting in failures or timeouts being returned to the platform management software. A warm reset may be necessary for SB-RMI accesses to be restored.

Suggested Workaround

None.

Fix Planned

No fix planned

704 Processor May Report Incorrect Instruction Pointer

Description

Under a highly specific and detailed set of internal timing conditions, the processor may store an incorrect instruction pointer (rIP) while processing an interrupt or a debug trap exception (#DB).

Potential Effect on System

Unpredictable system behavior.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

707 Performance Counter for Locked Operations May Count Cycles from Non-Locked Operations

Description

PMCx024[2] may include cycles spent performing non-locked operations.

Potential Effect on System

Performance monitoring software may receive an incorrect (larger) count of the number of cycles spent in the non-speculative phase of locked operations.

Suggested Workaround

None.

Fix Planned

No fix planned

709 Processor May Be Limited to Minimum P-state After a P-state Limit Change

Description

Following a change to the P-state limit, the processor may incorrectly restrict the processor to the lowest-performing P-state (Clock Power/Timing Control 2 Register[HwPstateMaxVal], D18F3xDC[10:8]). This restriction may not match any of the actual P-state limits and does not get removed until a processor reset occurs.

P-state limit changes that may cause this erratum may be due to SB-RMI (SBI P-state Limit[PstateLimit], MSRC001_0072[10:8]), software (Software P-state Limit Register[SwPstateLimit], D18F3x68[30:28]), or hardware thermal control (entering HTC-active state, i.e. PROCHOT# assertion).

Potential Effect on System

Processor performance is limited to the lowest-performing P-state.

Suggested Workaround

Contact your AMD representative for information on a BIOS update.

Fix Planned

No fix planned

712 Processor May Hang During Graphics Memory Controller Sequencing

Description

The processor may hang during a graphics memory controller (GMC) sleep state transitioning. The failure may be processor specific and may be sensitive to temperature.

Potential Effect on System

System hang.

Suggested Workaround

BIOS should set D18F2x408_dct[1:0] bit 31 = 1b.

Fix Planned

No fix planned

713 Processor May Hang Due to Short Graphics Memory Controller Activity

Description

The processor may hang if LCLK deep sleep is enabled (LCLK_DEEP_SLEEP_CNTL[EnableDs], GMMx7A0[31] is 1b) and a short burst of activity occurs from the graphics memory controller.

Potential Effect on System

System hang.

Suggested Workaround

BIOS should set GMMx7A0[31] = 0b.

Fix Planned

No fix planned

715 Processor May Alter Machine Check Registers on a Warm Reset

Description

The processor may alter warm-reset persistent bits in MC0_STATUS (MSR0000_0401), MC0_ADDR (MSR0000_0402), MC0_MISC (MSR0000_0403), MC2_STATUS (MSR0000_0409), MC2_ADDR (MSR0000_040A), MC2_MISC (MSR0000_040B), MC5_STATUS (MSR0000_0415), MC5_ADDR (MSR0000_0416), MC5_MISC (MSR0000_0417), MC6_STATUS (MSR0000_0419) and MC6_ADDR (MSR0000_040A) during a warm reset. The status bits may be cleared of an actual error indication, or may be written to a non-zero value that does not correlate to an actual machine check error.

A machine check exception (#MC) is not created when these registers are incorrectly altered.

This erratum is only observed when the processor core operating frequency is less than 900 MHz at the time of the warm reset.

Potential Effect on System

The operating system software may place the incorrect machine check status information in an error log.

In the event that the warm-reset was the result of an actual machine check, the processor may also over-write the machine check information and the reason for the warm reset is not available for diagnostic purposes.

Suggested Workaround

Do not operate the processor core frequency less than 900 MHz. Software should not modify any of the P-state[7:0] Registers (MSRC001_00[6B:64]) such that the CpuFid (bits 5:0) and the CpuDid (bits 8:6) specify a core operating frequency that is less than 900 MHz.

Some processors have a default configuration where the hardware thermal control (HTC) P-state is configured for a core frequency of 800 MHz. BIOS should perform the following algorithm to adjust this configuration:

1. Read Hardware Thermal Control Register[HtcPstateLimit] (D18F3x64[30:28])
2. Use this value to index into the P-state Registers to the P-state register used in HTC mode (MSR(C001_0064 + HtcPstateLimit)).
3. Read this MSR and check if bits 8:6 (CpuDid) is 1h and bits 5:0 (CpuFid) is 0h. If these values are not observed, the algorithm ends at this step.
4. Read the MSR of the next higher-performing P-state register (MSR(C001_0064 + HtcPstateLimit - 1)), and save the value for CpuVid (bits 16:9).
5. Write the HTC P-state MSR (MSR(C001_0064 + HtcPstateLimit)) with CpuFid = 2h and the saved CpuVid from the previous step. The other fields in this MSR are unchanged.

The above algorithm should be run by BIOS before entering CC6 mode and before enabling hardware thermal control (before writing Hardware Thermal Control Register[HtcEn] (D18F3x64[0]) = 1b).

Fix Planned

No fix planned

716 Warm Reset After BIOS Changes P-state During Early Boot May Cause System Hang

Description

A warm reset that occurs following a BIOS change to the P-state may cause a system hang. In order for this erratum to occur, the BIOS change to the P-state must occur while at least one processor core has the corresponding core enable (CpuEn, D18F0x1DC[7:1]) bit clear after a reset.

Potential Effect on System

System hang.

Suggested Workaround

The system BIOS should not perform a P-state change before the core enable bits are set for all cores.

Fix Planned

No fix planned

718 Instruction-Based Sampling May Be Inaccurate

Description

The processor may experience sampling inaccuracies when Instruction-Based Sampling (IBS) is enabled in the following cases:

- The processor may set IBS Op Data 3 Register[IbsDcStToLdCan, IbsDcStToLdFwd] (MSRC001_1037[12, 11]) incorrectly for load instructions that are tagged for IBS if there was a recently executed store instruction whose store address matches the load address in bits 11:0.
- When performing an IBS execution sample, the processor only sets, but never clears, the following bits:
 - IbsDcL2TlbMiss (MSR C001_1037[3])
 - IbsDcL2TlbHit2M (MSR C001_1037[6])
 - IbsDcL2TlbHit1G (MSR C001_1037[19])
- The processor incorrectly updates IBS Op Data 2 Register[NbIbsReqCacheHitSt, NbIbsReqDstProc, NbIbsReqSrc] (MSR C001_1036[5,4,2:0]) during an IBS fetch sample. If both IBS execution sampling (IBS Execution Control[IbsOpEn], MSRC001_1033[17] = 1b) and IBS fetch sampling (IBS Fetch Control[IbsFetchEn], MSRC001_1030[48] = 1b) are enabled simultaneously, valid execution sample data may be overwritten by a fetch sample resulting in IBS data that is inconsistent with the accompanying IBS execution sample data.
- The processor may infrequently report an incorrect instruction pointer in the IBS Fetch Linear Address (MSRC001_1031).

Potential Effect on System

Inaccuracies in performance monitoring software may be experienced.

Suggested Workaround

The following workarounds can be used for the above issues:

- No workaround exists for IbsDcStToLdCan and IbsDcStToLdFwd. These bits would not significantly over-indicate a store to load forwarding with most code.
- Performance monitoring software should clear the IBS Op Data 3 Register (MSR C001_1037[63:0] = 0) between each IBS sample.
- Performance monitoring software should not rely on MSRC001_1036 if both IBS execution sampling and IBS fetch sampling are enabled simultaneously.
- Performance monitoring software should not rely on MSRC001_1031.

Fix Planned

No fix planned

719 Instruction-Based Sampling Fetch Counter Always Starts at Maximum Value

Description

When setting IBS Fetch Control Register[IbsFetchEn] = 1b to enable IBS fetch sampling, the periodic fetch counter always starts at the maximum value programmed into IBS Fetch Control Register[IbsFetchMaxCnt] (MSRC001_1030[15:0]) instead of starting at the value written into IBS Fetch Control Register[IbsFetchCnt] (MSRC001_1030[19:4]).

Potential Effect on System

System software that is managing multiple processes or virtual machines with different IBS configurations may create unintended delays before the next IBS sample by writing to MSRC001_1030.

In the event that system software consistently writes to MSRC001_1030, it is possible that the IBS fetch counter never expires and no instruction fetches are tagged. AMD has not observed this effect with production software.

Suggested Workaround

None.

Fix Planned

No fix planned

720 Processor May Not Respect Interrupt Shadow

Description

Under a highly specific and detailed set of internal timing conditions, a #DB exception may be presented during execution of an instruction that is in an interrupt shadow. In order for this erratum to occur, the other processor core in the compute-unit must be performing microcoded functions that are uncommon in usage.

Potential Effect on System

Under rare circumstances, a debug exception may occur in an interrupt shadow. Under common software use, this exception does not have a system effect. In the event that system software uses "STI, RET" instead of a single IRET instruction, or changes the stack segment simultaneously with the stack pointer (i.e. not using a flat segment for the stack), unpredictable system failure may result. AMD has not observed this erratum with any commercially available software.

Suggested Workaround

None.

Fix Planned

No fix planned

724 Unintercepted Halt Instruction May Cause Protocol Machine Check or Unpredictable System Behavior

Description

An unintercepted halt instruction executed in guest mode may result in a processor core being in a cache-flush-on-halt state while having VMCB data in the cache.

Potential Effect on System

Northbridge machine check exception (#MC) for a link protocol error. This machine check exception causes a sync flood and system reset under AMD recommended BIOS settings. The machine check has the following signature:

- The MC4_STAT register (MSR0000_0411) is equal to BA000020_000B0C0F. Bit 62 (error overflow) or bit 59 (miscellaneous valid) of MC4_STAT may or may not be set.
- Bits 5:1 of the MC4_ADDR register (MSR0000_0412) is equal to one of 10011b, 10100b, 11000b or 11001.

In addition, it is possible for unpredictable system operation to occur without a machine check exception. For example, a processor core may not observe a write that is performed by another processor core. AMD has not observed this effect in any commercially available software.

Suggested Workaround

Hypervisors should intercept HLT instructions by setting VMCB.Intercept_HLT (offset 00Ch bit 24) to 1b.

Fix Planned

No fix planned

725 Incorrect APIC Remote Read Behavior

Description

The processor may provide incorrect APIC register data on an APIC remote register read. A remote read is performed using Interrupt Command Register Low[MsgType] of 011b (APIC300[10:8]). The processor may, but does not always, provide an error indication in the remote read status field (APIC300[17:16]).

This erratum does not impact the use of remote APIC reads by BIOS during early power-on-self-test (POST) when the remote read is performed for addresses APIC300-APIC3F0.

Potential Effect on System

None expected, as it is anticipated that no software other than BIOS uses remote APIC reads.

Suggested Workaround

Software should not use remote APIC reads.

Fix Planned

No fix planned

726 Processor May Report Incorrect MCA Address for Loads that Cross Address Boundaries

Description

In the event that a line fill error or system read data error is reported for some, but not all, bytes of an unaligned load instruction that crosses a cache line boundary (64 bytes), the processor may intermittently report the address of the unaffected cache line in MC0_ADDR (MSR0000_0402).

Potential Effect on System

None expected.

Suggested Workaround

None.

Fix Planned

No fix planned

728 IOMMU Event Not Flagged when DTE Reserved Bits Are Not Zero

Description

The processor IOMMU may not generate an event log entry when a translation table walk encounters a valid device table entry (DTE) with reserved bits 8:2 not equal to 000_0000b. The reserved bits are ignored by the processor.

Potential Effect on System

None expected in the absence of IOMMU host software programming errors. In the presence of IOMMU host software programming errors, the device may receive and report a completion-abort response without an IOMMU event log to diagnose the reason for the completion-abort response. Debug information presented by the processor in the event logs may be missing.

Suggested Workaround

None.

Fix Planned

No fix planned

729 IOMMU Event Log Not Generated for Invalid DTE GCR3 Table Root Pointer

Description

The processor IOMMU does not generate an event log entry when a translation table walk encounters a valid device table entry (DTE) whose GCR3 table root pointer is not a valid system address. When the IOMMU is operating in nested paging mode, the erratum occurs only if the host page table translations of the GCR3 root pointer translates this address to an invalid system address.

Instead, the processor treats this as an IOMMU page fault.

Potential Effect on System

None expected in the absence of IOMMU host software programming errors. In the presence of IOMMU host software programming errors, debug information presented by the processor in the event logs may be missing or incorrect.

Suggested Workaround

None.

Fix Planned

No fix planned

730 IOMMU Event Log Not Generated for Not Present Host Intermediate Page Tables

Description

The processor IOMMU, when performing a nested address translation of a guest virtual address to a host physical address, does not generate event logs in the case that the table walk encounters an intermediate (non-leaf) host page table that is not present (valid bit is 0b). The IOMMU does abort this translation request and properly signals an I/O page fault.

This erratum does not impact IOMMU operation with peripherals that use address translation service (ATS) in conjunction with peripheral page service requests (PPR). When PPR is not used, the page tables used by the IOMMU translation typically requires "pinned" pages where the present or valid bit is always 1b.

Potential Effect on System

None expected in the absence of IOMMU or memory management software programming errors in the hypervisor or driver software errors in the guest. In the presence of programming errors, the device may receive and report a completion-abort response without an IOMMU event log to diagnose the reason for the completion-abort response. Debug information presented by the processor in the event logs may be missing.

Suggested Workaround

None.

Fix Planned

No fix planned

731 Incorrect Translation with IOMMU v1 512 GB Page Table

Description

The processor may perform incorrect IOMMU translations using an IOMMU v1 page table that has a page size of 512 GB.

Potential Effect on System

None expected. In the unlikely event that IOMMU software uses a 512 GB sized page table, unpredictable system behavior may result. AMD has not observed this erratum with any commercially available software.

Suggested Workaround

IOMMU software should limit the IOMMU v1 page table such that the page size is never greater than the system memory.

Fix Planned

No fix planned

732 IOMMU Event Log Ordering Violation

Description

The processor IOMMU does not maintain producer-consumer ordering between the IOMMU event log DMA writes and IOMMU MMIO register read completions. The processor core may read stale or uninitialized event logs from memory when a read response from the event log tail pointer register passes the corresponding event log DMA write. A series or burst of event log DMA writes would normally be necessary for this ordering violation to be observed.

Potential Effect on System

Software may process an event log before it has been completely written, possibly resulting in the operating system or Hypervisor taking improper corrective actions.

Suggested Workaround

The IOMMU driver of the hypervisor or operating system should initialize the event log buffer to all zeros and write event log entries to zero after they are processed. If software subsequently observes an all zero event log entry, it should re-read the buffer until a non-zero event log is returned. It is recommended that software detects that the log buffer has not been written by checking for an EventCode (bits 63:60) that is equal to 0000b.

Fix Planned

No fix planned

733 IOMMU PPR Log Ordering Violation

Description

The processor IOMMU does not maintain producer-consumer ordering between the IOMMU peripheral page service request (PPR) log DMA writes and IOMMU MMIO register read completions. The processor core may read stale or uninitialized PPR logs from memory when a read response from the PPR log tail pointer register passes the corresponding PPR log DMA write. A series or burst of PPR log DMA writes would normally be necessary for this ordering violation to be observed.

This erratum only applies in systems where a device is performing Address Translation Service (ATS) requests.

Potential Effect on System

Software may process a PPR log before it has been completely written, possibly resulting in the IOMMU software not properly processing a page service request. This may result in unpredictable IOMMU behavior.

Suggested Workaround

The IOMMU driver of the hypervisor or operating system should initialize the PPR log buffer to all zeros and write PPR log entries to zero after they are processed. If software subsequently observes an all zero PPR log entry, it should re-read the buffer until a non-zero PPR log is returned. It is recommended that software detects that the log buffer has not been written by checking for a PPRCode (bits 63:60) that is equal to 0000b.

Fix Planned

No fix planned

Documentation Support

The following documents provide additional information regarding the operation of the processor:

- *BIOS and Kernel Developer's Guide (BKDG) for AMD Family 15h Models 10h-1Fh Processors*, order# 42300
- *AMD64 Architecture Programmer's Manual Volume 1: Application Programming*, order# 24592
- *AMD64 Architecture Programmer's Manual Volume 2: System Programming*, order# 24593
- *AMD64 Architecture Programmer's Manual Volume 3: General-Purpose and System Instructions*, order# 24594
- *AMD64 Architecture Programmer's Manual Volume 4: 128-Bit and 256-Bit Media Instructions*, order# 26568
- *AMD64 Architecture Programmer's Manual Volume 5: 64-Bit Media and x87 Floating-Point Instructions*, order# 26569
- *AMD CPUID Specification*, order# 25481
- *Advanced Platform Management Link (APML) Specification*, order# 41918

See the AMD Web site at www.amd.com for the latest updates to documents.